

**WHAT IS CLAIMED IS:**

1. A multi-layer substrate comprising:
  - a plurality of metal layers each having a predetermined printed-circuit pattern
  - 5 formed thereon; and
  - at least one insulating layer formed between each of the metal layers,
  - wherein the plurality of metal layers includes:
  - at least two high-frequency signal layers for transmitting a high-frequency signal;
  - and
  - 10 at least one ground layer to provide a ground for other metal layers, and
  - wherein at least one via hole is formed through the multi-layer substrate to connect the high-frequency signal layers to each other, and an impedance-matching hole passes through the ground layer so as to provide a path through which the via hole passes, and
  - wherein a distance between the via hole and the ground layer is adapted for
  - 15 adjustment by the impedance-matching hole to adjust capacitance from the via hole to ground and for making quasi waveguide with intrinsic inductance of the via hole, so that impedances of the multi-layer substrate are matched when a high-frequency signal is transmitted among the signal layers.
- 20 2. The multi-layer substrate as claimed in claim 1, further comprising a signal pad in the same metal layer with the ground layer which is electrically connected to an exterior wall of the via hole, said signal pad extends outside of the via hole.

3. The multi-layer substrate as claimed in claim 2, wherein the signal pad has a ring shape, and a capacitance between the ground layer and the via hole is adjusted according to an inductance of the via hole and the dielectric constant and the thickness of the insulating layer, so that a quasi waveguide is formed and impedances of the multi-layer  
5 substrate are matched.

4. The multi-layer substrate as claimed in claim 1, wherein ground pads are provided in all or some metal layers except ground layers, in which the ground pads are electrically connected with the ground layer through the via hole and serves as a ground.

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5. The multi-layer substrate as claimed in claim 4, wherein the signal pads have ring shape and are formed in all metal layers having the ground pad, and a capacitance between the ground pad and the signal pad is adjusted according to an inductance of the hole between continual ground pads or ground layer, a dielectric constant and a thickness of  
15 the insulating layer, so that a quasi waveguide is formed and impedances of the multi-layer substrate are matched.

6. The multi-layer substrate as claimed in claim 4, wherein a capacitance between the ground pad and the via hole is selectively adjusted according to an inductance of the via  
20 hole connected to the capacitance, a dielectric constant and a thickness of the insulating layer, so that a quasi waveguide is formed by the capacitance and the inductance, thus matching impedances of the multi-layer substrate.

7. A multi-layer substrate comprising:

a plurality of metal layers, on each of which a predetermined printed-circuit pattern is formed;

at least two insulating layer formed between the metal layers; and

5 at least one signal pad which is electrically connected to a via hole to increase an attaching force between layers of the substrate when a high-frequency signal, a low-frequency signal, or DC is transmitted from one layer to another layer through the via hole.

8. The multi-layer substrate according to claim 7, wherein at least one Teflon  
10 substrate further comprises the signal pad formed on metal layer pre-attached on a Teflon substrate to increase an attaching force between the Teflon layer and to prepreg which is used to attach substrates and become substrate after thermal treatment.

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